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[Title of the Invention] Ultraviolet Radiation Apparatus for Liquid Crystal Display

[Abstract]

Provided is an ultraviolet radiation apparatus for a liquid crystal display for curing a sealing material formed around two substrates of a liquid crystal cell. The ultraviolet radiation apparatus includes a ultraviolet lamp for generating ultraviolet light to radiate ultraviolet light to the sealing material, a support frame for supporting one substrate of the two substrates during the ultraviolet curing, and a reflective plate disposed on the support frame and reflecting the radiated ultraviolet light in various directions to induce the light to the sealing material. At this time, the reflective plate is disposed on the support frame to scatter ultraviolet light at a lower part of the liquid crystal cell, or disposed at side surfaces of the liquid crystal cell to reflect the ultraviolet light at side surfaces of the liquid crystal cell, thereby inducing the ultraviolet light to the sealing material in various directions and angles. Preferably, the reflective plate has a curved, embossed, or ground surface to increase a degree of cure of the sealing material. Therefore, it is possible to sufficiently radiate ultraviolet light to the sealing material formed under a black matrix using the reflective plate.

[Representative Drawing]

FIG. 3A

[Keywords]

Liquid crystal, Ultraviolet light curing agent, Sealing material, Curing, Reflection, Scattering

[Specification]

[Brief Description of the Drawings]

FIG. 1 is a plan view illustrating the structure of a liquid crystal panel for a liquid crystal display completed using an ultraviolet radiation apparatus in accordance with an exemplary embodiment of the present invention;

FIG. 2 is a cross-sectional view taken along line II-II' of FIG. 1;

FIG. 3A is a view of an apparatus for manufacturing a liquid crystal display in accordance with a first exemplary embodiment of the present invention;

FIG. 3B is a cross-sectional view of a support frame for supporting a substrate of the liquid crystal display of FIG. 3A;

FIG. 4 is a view of an ultraviolet radiation apparatus for a liquid crystal display in accordance with a second exemplary embodiment of the present invention;

FIG. 5 is a view of an ultraviolet radiation apparatus for a liquid crystal display in accordance with a third exemplary embodiment of the present invention;

FIG. 6 illustrates a specimen for measuring a degree of cure of a sealing

material using an ultraviolet radiation apparatus for a liquid crystal display in accordance with an experimental example of the present invention;

FIG. 7 is a graph showing a degree of cure of ultraviolet light depending on use of a reflective plate and the depth of a dark part; and

FIGS. 8 to 11 schematically illustrate ultraviolet radiation apparatuses for a liquid crystal display in accordance with fourth to seventh exemplary embodiments of the present invention.

[Detailed Description of the Invention]

[Object of the Invention]

[Technical Background and Description of the Prior Arts]

The present invention relates to an ultraviolet radiation apparatus for a liquid crystal display, and more particularly, to an ultraviolet radiation apparatus for a liquid crystal display capable of curing a sealing material used to adhere two substrates constituting a liquid crystal display during a process of manufacturing the liquid crystal display.

Generally, a liquid crystal display includes two substrates having electrodes, and a liquid crystal material injected between the two substrates. The two substrates are engaged with each other by a sealing material printed therearound and trapping the liquid crystal material, and supported by spacers distributed between the two substrates.

The liquid crystal display applies an electric field to a liquid crystal material injected between the two substrates and having anisotropic permittivity using electrodes, and adjusts the magnitude of the electric field to adjust

luminous intensity of the light transmitted through the substrates, thereby displaying an image.

In a method of manufacturing the liquid crystal display, first, interconnections for transmitting signals to two substrates, electrodes electrically connected to the interconnections, and a color filter for representing various colors are formed. Then, after applying an alignment layer for aligning liquid crystal molecules of a liquid crystal material on the two substrates and orienting the liquid crystal molecules, distributing spacers on one substrate of the two substrates, and printing a sealing material around the substrate to form a liquid crystal injection port. Next, the two substrates are adhered to each other using the sealing material after aligning the two substrates, a liquid crystal material is injected through the liquid crystal injection port, and the liquid crystal injection port is sealed to form a liquid crystal cell. At this time, the sealing material may be a heat curable material or an ultraviolet curable material. When the ultraviolet curable material is used as the sealing material, a process of adhering the two substrates while radiating ultraviolet light is performed.

However, in the method of manufacturing the liquid crystal display, when ultraviolet light is radiated to adhere the two substrates in a direction of a black matrix for blocking light emitted around a display region in which an image is displayed, or a signal line for transmitting a scan signal or an image signal, the radiated ultraviolet light may be blocked by the interconnections to make the sealing material overlapping the interconnections be imperfectly cured. As a result, the two substrates may be imperfectly adhered to cause poor adhesion between the two substrates.

[Technical Object of the Invention]

It is an object of the present invention to provide an ultraviolet radiation apparatus for a liquid crystal display capable of preventing two substrates from being badly adhered to each other.

[Constitution and Operation of the invention]

In order to accomplish the object, the present invention prov ides an ultraviolet radiation apparatus for a liquid crystal display including a scattering plate or a reflective plate for radiating ultraviolet light to a sealing material in various angles.

Specifically, the ultraviolet radiation apparatus for a liquid crystal display includes an ultraviolet apparatus for emitting ultraviolet light; a support frame for supporting a liquid crystal cell having two substrates opposite to each other when the ultraviolet light is radiated, and a sealing material formed around the two substrates and formed of an ultraviolet curable material; and a reflective plate disposed under or at side surfaces of the liquid crystal cell, and reflecting ultraviolet light emitted from the ultraviolet apparatus to various positions and in various directions to induce the ultraviolet light to the sealing material.

Here, the reflective plate may be disposed on the support frame to reflect the ultraviolet light under the liquid crystal cell, and may have curved surfaces to scatter the ultraviolet light.

The ultraviolet radiation apparatus for a liquid crystal display in accordance with the present invention may further include a scattering plate

disposed between the liquid crystal cell and an ultraviolet lamp to scatter the emitted ultraviolet light.

In addition, the reflective plates may be disposed at side surfaces of the liquid crystal cell. The reflective plates may have curved surfaces, or ground or embossed surfaces to reflect the ultraviolet light in various angles.

Hereinafter, the present invention will now be described more fully with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown. In addition, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

First, the structure of a liquid crystal display will be described in brief with reference to FIGS. 1 and 2.

FIG. 1 is a plan view illustrating the structure of a liquid crystal panel for a liquid crystal display completed using an ultraviolet radiation apparatus in accordance with an exemplary embodiment of the present invention, and FIG. 2 is a cross-sectional view taken along line II-II' of FIG. 1.

As shown in FIGS. 1 and 2, the liquid crystal display in accordance with the present invention includes insulating layers 100 and 200 opposite to each other, a liquid crystal material layer 300 injected between the two substrates 100 and 200, and a sealing material 150 formed around a display region D of the two substrates 100 and 200 to seal the liquid crystal material layer 300 injected therebetween and formed of a ultraviolet curable material. At this time, spherical spacers (not shown) may be mixed in the liquid crystal material layer 300 to parallelly support the two substrates 100 and 200, and the sealing

material 150 may also contain the spacers. Meanwhile, the spacers may be projections formed of silicon nitride or organic insulating material.

As shown in FIGS. 1 and 2, the lower substrate 100 of the liquid crystal display in accordance with an exemplary embodiment of the present invention is formed of a low-resistance conductive material, and includes a gate interconnection 20 for transmitting a scan signal, a data interconnection 60 crossing the gate interconnection to transmit an image signal. At this time, the gate interconnection 20 includes a gate line formed in the display region D to transmit a scan signal, a gate pad formed in a pad region P to transmit the scan signal received from the gate line to the exterior, and a gate electrode of a thin film transistor connected to the gate line. Here, the gate interconnection 20 may include a sustain electrode parallel to the gate line and receiving a voltage such as a common electrode voltage from the exterior. The sustain electrode is electrically connected to the gate interconnection 20 and the data interconnection 60 and overlaps a pixel electrode (not shown) to which the image signal is transmitted, thereby constituting a sustain electric condenser for improving charge storage capability. In addition, the data interconnection 60 includes a data line dielectrically crossing the gate line in the display region D to define a unit pixel region, a data pad formed in the pad region P and receiving an image signal from the exterior to transmit the image signal to the data line, a source electrode of a thin film transistor connected to the data line, and a drain electrode of the thin film transistor separated from the source electrode and opposite to the source electrode with a channel part of the thin film transistor interposed therebetween. In addition, a pixel electrode is defined by the gate

line and the data line, formed in the pixel region arrayed in a matrix manner to be connected to the drain electrode of the thin film transistor, and formed of a transparent conductive material such as indium tin oxide (ITO) or indium zinc oxide (IZO) or a non-transparent conductive material having high reflectivity.

Further, the upper substrate 200 opposite to the lower substrate 100 has a black matrix 210 having an opening formed in the pixel region arrayed on the upper insulating substrate 210 in a matrix manner and formed around the display region D to block light leaked around the display region D. In addition, red, green and blue color filters (not shown) are sequentially and parallelly formed in each pixel region on the upper insulating substrate 201 in a column direction. At this time, the red, green and blue color filters may be parallelly formed in a straight line such that the red, green and blue color filters of adjacent pixel rows may be arranged in the same color, or the red, green and blue color filters of adjacent pixel rows may be arranged to have different colors in a zigzag manner. At this time, a passivation layer for covering the red, green and blue color filters and having good planarization characteristics may be additionally provided on the upper insulating substrate 201.

While not shown, the opposite two substrates 101 and 201 may further include an alignment layer formed between the two substrates 101 and 201 to align liquid crystal molecules of the liquid crystal material layer 300 in a specific direction.

In the method of manufacturing the liquid crystal display, a sealing material 150, an ultraviolet curable material, is formed around one upper display region D of the two substrates 100 and 200. As shown, the sealing material

150 is formed to overlap the black matrix 210 to optimize the size of the substrates 100 and 200. However, when the two substrates 100 and 200 are aligned and pressed to each other and then ultraviolet light is radiated to the sealing material 150 to adhere the two substrates 100 and 200, i.e., when ultraviolet light is radiated on and under the two substrates 100 and 200 to cure the sealing material 150 to adhere the two substrates 100 and 200, the ultraviolet light is blocked by the gate interconnection 20, the data interconnection 60, or the black matrix 210 to make it difficult to radiate the ultraviolet light to a portion of the sealing material overlapping the gate interconnection 20, the data interconnection 60, or the black matrix 210, thereby causing the portion to be not cured. As a result, the two substrates 100 and 200 may be badly adhered, and the uncured sealing material 150 may be mixed with the liquid crystal material of the liquid crystal material layer 300 to contaminate the liquid crystal material, thereby decreasing display characteristics of the liquid crystal display. In order to maximize a degree of cure of the sealing material 150, the ultraviolet radiation apparatus for a liquid crystal display in accordance with an exemplary embodiment of the present invention includes a reflective plate or a scattering plate for radiating ultraviolet light under and sides of the substrates 100 and 200 in various angles, or ultraviolet radiation a pparatuses may be attached to both sides of the two substrates 100 and 200. Therefore, it is possible for the ultraviolet radiation apparatus for a liquid crystal display to radiate ultraviolet light in various angles to obtain a degree of cure of 90% or more. Hereinafter, the ultraviolet radiation apparatus for a liquid crystal display in accordance with an exemplary

embodiment of the present invention will be described with reference to the accompanying drawings.

FIG. 3A is a view of an apparatus for manufacturing a liquid crystal display in accordance with a first exemplary embodiment of the present invention, and FIG. 3B is a cross-sectional view of a support frame for supporting a substrate of the liquid crystal display of FIG. 3A. Here, in order to specifically show reflection or scattering of ultraviolet light, the substrates 100 and 200 are partially shown.

As shown in FIG. 3A and 3B, the ultraviolet radiation apparatus for a liquid crystal display in accordance with a first exemplary embodiment of the present invention, similar to FIGS. 1 and 2, functions to prevent leakage of a liquid crystal material of the liquid crystal material layer 300 from the liquid crystal cell formed of the two substrates 100 and 200 and the sealing material 150, and cure the sealing material 150 formed of a ultraviolet curable material to uniformly maintain a gap between the two substrates 100 and 200. The ultraviolet radiation apparatus includes an ultraviolet lamp 510 for generating ultraviolet light to radiate the ultraviolet light to the sealing material 150, a support frame 520 for supporting one substrate 100 of the two substrates 100 and 200 during the ultraviolet curing, and a reflective plate 530 disposed on the support frame 520 to reflect the radiated ultraviolet light in various directions. At this time, the reflective plate 530 may be integrally formed with the support frame 520 to use the support plate 520 as the reflective plate.

At this time, the reflective plate 530 is formed of a material having good reflectivity, and ground to scatter the ultraviolet light radiated under the lower

substrate 100 in various directions to be formed as the scattering plate 530 having curved surfaces.

In the ultraviolet radiation apparatus for a liquid crystal display in accordance with the present invention, while the black matrix 210 blocks the ultraviolet light directed to the sealing material 150 formed under the black matrix 210, the ultraviolet light passed through the two substrates 100 and 200 is reflected by the reflective plate 530 disposed thereunder in various directions to be radiated to the sealing material 150 formed under the black matrix 210 to sufficiently cure the sealing material 150 formed under the black matrix 210 using ultraviolet light, thereby maximizing a degree of cure of the sealing material 150. Of course, though the radiated ultraviolet light is blocked by the interconnections 20 and 60 when the lower substrate 100 is disposed adjacent to the ultraviolet lamp 510, it is possible to obtain the same effect. Therefore, it is possible to prevent contamination of the liquid crystal material of the liquid crystal material layer 300 due to the sealing material 150, and bad contact between the two substrates 100 and 200.

In addition, the ultraviolet radiation apparatus for a liquid crystal display in accordance with the present invention may further include a spacer disposed such that the ultraviolet light emitted from the ultraviolet lamp is scattered or reflected by the scattering plate or the reflective plate in a wide area in various directions, which will be described in detail with reference to the accompanying drawings.

FIG. 4 is a view of an ultraviolet radiation apparatus for a liquid crystal display in accordance with a second exemplary embodiment of the present

invention, and FIG. 5 is a view of an ultraviolet radiation apparatus for a liquid crystal display in accordance with a third exemplary embodiment of the present invention.

As shown in FIG. 4, the ultraviolet radiation apparatus for a liquid crystal display in accordance with a second exemplary embodiment of the present invention is similar to the first embodiment.

However, the second embodiment includes a scattering plate 540 disposed between an ultraviolet lamp 510 and liquid crystal cells 100 and 200, to scatter radiated ultraviolet light.

When ultraviolet light is radiated to cure a sealing material 150 using the ultraviolet radiation apparatus for a liquid crystal display in accordance with a second exemplary embodiment of the present invention, in addition to the effect of the first embodiment, it is possible to primarily scatter the radiated ultraviolet light using the scattering plate 540 disposed between the ultraviolet lamp 510 and the liquid crystal cells 100 and 200, and secondarily reflect the ultraviolet light using the reflective plate 530 in a scattered manner to cure the sealing material 150, thereby perfectly curing the sealing material 150 formed in a deeper part of the dark part.

In addition, as shown in FIG. 5, the ultraviolet radiation apparatus for a liquid crystal display in accordance with a third exemplary embodiment of the present invention has substantially the same structure as the second embodiment.

However, a spacer 600 is disposed between a reflective plate 520 and a lower substrate 100 of the liquid crystal cell to support the liquid crystal cells.

At this time, the spacer 600 may be formed of a transparent material, or a material having scattering characteristics.

When ultraviolet light is radiated to cure a sealing material 150 using the ultraviolet radiation apparatus for a liquid crystal display in accordance with a third exemplary embodiment of the present invention, in addition to the effect of the first embodiment, it is possible to more widely and densely radiate the ultraviolet light reflected by the reflective plate 520, thereby perfectly curing the sealing material 150 formed in a deeper part of the dark part.

Hereinafter, an experimental example, in which a sealing material is cured using the ultraviolet radiation apparatus for a liquid crystal display in accordance with an exemplary embodiment of the present invention, will be described in detail.

[Experimental Example]

FIG. 6 illustrates a specimen for measuring a degree of cure of a sealing material using an ultraviolet radiation apparatus for a liquid crystal display in accordance with an experimental example of the present invention, and FIG. 7 is a graph showing a degree of cure of ultraviolet light depending on use of a reflective plate and the depth of a dark part. In FIG. 6, a dotted part represents a dark part coated with chrome, a rectangular part represents a portion in which an ultraviolet curable sealing material is formed, and ● points represent positions where degrees of cure are measured. Here, the degree of cure of the sealing material was measured at six points. As shown, a first point is located at a portion which is not blocked by the dark part, and second to sixth

points are located at positions spaced apart from an interface of the dark part by 50, 180, 330, 530 and 1300μm. In FIG. 7, ■ represents a degree of cure of the sealing material when the reflective plate was used, and ♦ represents a degree of cure of the sealing material when the reflective plate was not used.

In Experimental Example, two glass substrates having a thickness of 0.7mm were used, chrome (Cr) was coated on one substrate to form the dark part covering the sealing material, and the ultraviolet curable sealing material was applied on one substrate to adhere the two substrates, thereby forming only the reflective plate on the support frame for supporting the substrate, similar to the first embodiment of the present invention. In addition, the degree of cure of the sealing material was used as the Raman spectrum measuring a reduction ratio of a peak of $1631cm^{-1}$ representing a double bond between carbons joined in curing reaction with respect to a peak of $1608cm^{-1}$ representing a benzene ring structure representing only an amount of specimen, without joining in the curing reaction.

As shown in FIG. 7, when the reflective plate was not used, the degree of cure of the sealing material was measured as 90% or more from the first pint to the second point disposed at 50μm from the interface of the dark part. However, the degrees of cure of the sealing material at the other points were 50% to 0%. In the case of using the reflective plate as the embodiment of the present invention, since the degrees of cure of the sealing material at the all points were measured as 90% or more, it will be appreciated that the ultraviolet light is substantially radiated to a lower part of the dark part to cure the sealing material.

While the first to third embodiments of the present invention have the reflective plate or the scattering plate disposed on and under the substrate to increase the degree of cure of the sealing material, the reflective plate and the scattering plate may be disposed at side surfaces of the substrate to increase the degree of cure of the ultraviolet light, which will be described in detail with reference to the accompanying drawings.

FIGS. 8 to 11 schematically illustrate ultraviolet radiation apparatuses for a liquid crystal display in accordance with fourth to seventh exemplary embodiments of the present invention.

As shown in FIG. 8, the ultraviolet radiation apparatus for a liquid crystal display in accordance with a fourth exemplary embodiment of the present invention includes an ultraviolet lamp 510 for generating ultraviolet light to radiate a sealing material 150, a support frame 520 for supporting one substrate 10 of two substrates 100 and 200 during the ultraviolet curing, and reflective plates 550 disposed at side surfaces of a liquid crystal cell formed of the two substrates 100 and 200 to reflect ultraviolet light emitted from the ultraviolet lamp 510 at side surfaces of the liquid crystal cell.

The ultraviolet radiation apparatus for a liquid crystal display in accordance with the fourth exemplary embodiment of the present invention uses the reflective plates 550 to reflect ultraviolet light at the side surfaces of the liquid crystal cell to cure the ultraviolet curable sealing material 150 overlapping the black matrix 210 and formed under the black matrix 210, thereby maximizing the degree of cure of the sealing material 150.

In addition, as shown in FIG. 9, the ultraviolet radiation apparatus for a

liquid crystal display in accordance with a fifth exemplary embodiment of the present invention includes reflective plates 550 having different heights and disposed at side surfaces of two substrates 100 and 200. Therefore, the ultraviolet light reflected and radiated by the reflective plates 550 cures the sealing material 150 formed under the black matrix 210 in various directions to maximize the degree of cure of the sealing material 150.

Further, as shown in FIG. 10, the ultraviolet radiation apparatus for a liquid crystal display in accordance with a sixth exemplary embodiment of the present invention includes reflective plates 550 having curved surfaces 551 to reflect ultraviolet light emitted from the ultraviolet lamp 510 in various angles. Therefore, it is possible to cure the sealing material 150 formed under the black matrix 210 in various directions to maximize the degree of cure of the sealing material 150.

Further, as shown in FIG. 11, the ultraviolet radiation apparatus for a liquid crystal display in accordance with a seventh exemplary embodiment of the present invention includes reflective plates 550 having curved surfaces 552 which are embossed or ground to reflect ultraviolet light emitted from the ultraviolet lamp 510 in various angles, similar to the sixth embodiment. Therefore, it is possible to cure the sealing material 150 formed under the black matrix 210 in various directions to maximize the degree of cure of the sealing material 150.

While the upper substrate 200 is disposed adjacent to the ultraviolet lamp 510 to radiate the ultraviolet light in the first to seventh embodiments, the lower substrate 100 may be disposed adjacent to the ultraviolet lamp 510.

Even in this case, it is possible to cure the sealing material 150 disposed under the interconnections 20 and 60 (see FIGS. 1 and 2) using reflection means and scattering means, thereby maximizing the degree of cure of the sealing material 150.

In addition, while the ultraviolet radiation apparatus for a liquid crystal display in accordance with the first to third exemplary embodiments of the present invention includes the reflective plates disposed under the liquid crystal panels 100 and 200, and the ultraviolet radiation apparatus for a liquid crystal display in accordance with the fourth to seventh exemplary embodiments of the present invention includes the reflective plates disposed at side surfaces of the liquid crystal panels 100 and 200, the reflective plates may be disposed under and side surface of the crystal panels 100 and 200 in other exemplary embodiments of the present invention.

While the ultraviolet radiation apparatus for a liquid crystal display in accordance with the first to seventh exemplary embodiments of the present invention may be adapted to a method of manufacturing a liquid crystal display by injecting a liquid crystal material through a liquid crystal injection port to form a liquid crystal material layer 300, the liquid crystal material may be injected between the two substrate 100 and 200 or dropped onto one of the two substrates 100 and 200 to form the liquid crystal material layer 300 (a method of manufacturing a liquid crystal display using a liquid crystal drop method), which will be described in detail.

First, after forming an alignment layer on one or both of the substrates 100 and 200 having one or a plurality of liquid crystal cell regions, alignment

treatment is performed to align liquid crystal molecules of the liquid crystal material layer 300 in arbitrary directions in an initial state through rubbing using friction and ultraviolet radiation.

Then, spacers are distributed on one of the two substrates 100 and 200 to a desired density to maintain a gap between the two substrates 100 and 200. At this time, when a thin film transistor and an interconnection are fabricated to form spacing projections during the process of adhering the two substrates 100 and 200, it is possible to skip the process of distributing the spacers.

Next, a sealing material 150 is applied on the substrate, in which the spacers are distributed, in liquid crystal cell region units. At this time, the sealing material 150 forms a closed line as shown in FIG. 1 not to have a liquid crystal injection port. The sealing material 150 may be formed of a heat curable material or an ultraviolet curable material, and may include spacers for maintaining a gap between the two substrates 100 and 200. Meanwhile, the sealing material 150 may form an anti-reaction layer on a surface of the sealing material 150 to prevent the liquid crystal material layer 300 from reacting with the sealing material 150.

Then, a liquid crystal material is dropped inside the sealing material 150 on the substrates 100 and 200, on which a predetermined amount of sealing material 150 is formed, such that the liquid crystal material layer 300 is formed depending on the size of the liquid crystal cell using a liquid crystal application device.

At this time, it is preferable to precisely adjust the amount of the liquid crystal material since there is no liquid crystal injection port in the sealing

material 150. When the amount of the liquid crystal material is large, the liquid crystal material may damage the sealing material 150 during a process of adhering the two substrates, and when the amount of the liquid crystal material is small, there may be a portion, in which the liquid crystal material layer 300 is not filled in the liquid crystal cell region surrounded by the sealing material 150. In order to solve the problem, the sealing material 150 may have various shapes of projections to form a buffer region at a periphery of the liquid crystal cell region, in which the liquid crystal material is not filled. That is, when a larger amount of liquid crystal material is applied in the liquid crystal cell region during a process of adhering the two substrates, in order to flow an excessive liquid crystal material, the sealing material 150 formed on the substrate may have a projection to provide at least buffer region.

Then, the two substrates 100 and 200 are adhered to each other in a vacuum state to complete the liquid crystal panel. At this time, the two substrates 100 and 200 are parallelly aligned on a press plate, and a uniform pressure is applied to the press plate to press the two substrates to form the liquid crystal material as the liquid crystal material layer 300, thereby maintaining a gap between the two substrates 100 and 200 as a desired gap of the cell.

Next, ultraviolet light is radiated with various heights and directions using the ultraviolet radiation apparatus for a liquid crystal display in accordance with first to seventh exemplary embodiments of the present invention to perfectly cure the sealing material 150, thereby adhering the two substrates 100 and 200 to each other.

Then, the completed liquid crystal panel is divided into liquid crystal cells for a liquid crystal display.

[Effects of the Invention]

As can be seen from the foregoing, an ultraviolet radiation apparatus for a liquid crystal display in accordance with an exemplary embodiment of the present invention includes a reflective plate or a scattering plate disposed on and under a liquid crystal cell and at side surfaces of the liquid crystal cell to radiate ultraviolet light in various heights and angles to cure a sealing material, thereby maximizing a degree of cure of the sealing material. Therefore, it is possible to prevent poor adhesion between the two substrates and contamination of a liquid crystal material due to the sealing material.

[Claims]

1. An ultraviolet radiation apparatus for a liquid crystal display comprising:

an ultraviolet apparatus for emitting ultraviolet light;

a support frame for supporting a liquid crystal cell having two substrates opposite to each other when the ultraviolet light is radiated, and a sealing material formed around the two substrates and formed of an ultraviolet curable material; and

reflective means disposed under the liquid crystal cell or at side surfaces of the liquid crystal cell to reflect the ultraviolet light emitted from the ultraviolet apparatus to various positions and in various directions to induce the ultraviolet light to the sealing material.

2. The ultraviolet radiation apparatus for a liquid crystal display according to Claim 1, wherein the reflective means is disposed on the support frame to reflect the ultraviolet light under the liquid crystal cell.

3. The ultraviolet radiation apparatus for a liquid crystal display according to Claim 2, wherein the reflective means has curved surfaces to scatter the ultraviolet light.

4. The ultraviolet radiation apparatus for a liquid crystal display according to Claim 3, wherein the reflective means is integrally formed with the support frame to use the support frame as the reflective means.

5. The ultraviolet radiation apparatus for a liquid crystal display according to Claim 1, further comprising scattering means disposed between the liquid crystal cell and the ultraviolet apparatus to scatter ultraviolet light.

6. The ultraviolet radiation apparatus for a liquid crystal display according to Claim 1, wherein the reflective means are disposed at side surfaces of the liquid crystal cell.

7. The ultraviolet radiation apparatus for a liquid crystal display according to Claim 6, wherein the reflective means has curved surfaces, or ground or embossed surfaces to reflect the ultraviolet light in various angles.

8. An ultraviolet radiation apparatus for a liquid crystal display comprising:

an ultraviolet apparatus for emitting ultraviolet light;

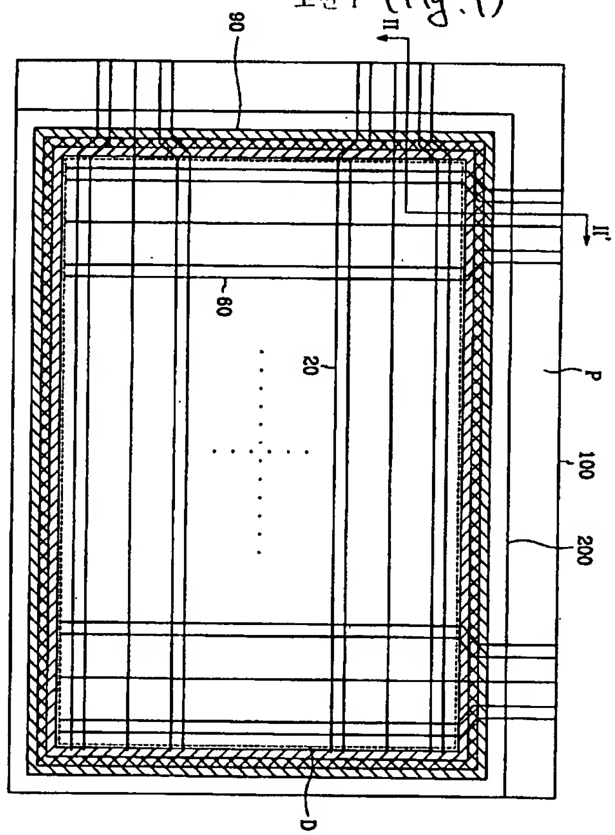
a support frame for supporting a liquid crystal cell having two substrates opposite to each other when the ultraviolet light is radiated, and a sealing material formed around the two substrates and formed of an ultraviolet curable material;

first reflective means disposed at side surfaces of the liquid crystal cell, and reflecting the ultraviolet light emitted from the ultraviolet apparatus to various positions and in various directions to induce the ultraviolet light to the sealing material; and

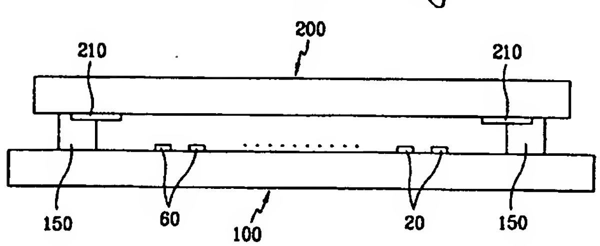
second reflective means disposed under the liquid crystal cell, and reflecting the ultraviolet light emitted from the ultraviolet apparatus to various positions and in various directions to induce the ultraviolet light to the sealing material.

도면

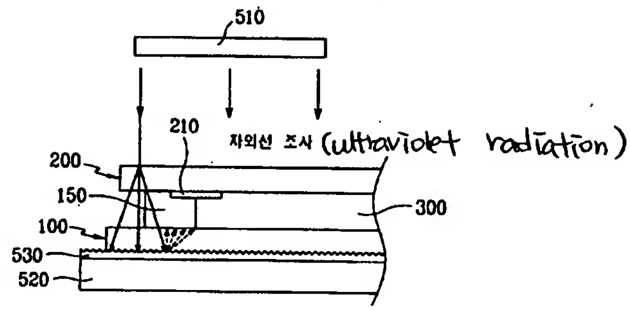
도면 1 (Fig. 1)



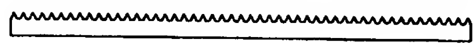
도면 2 (Fig. 2)



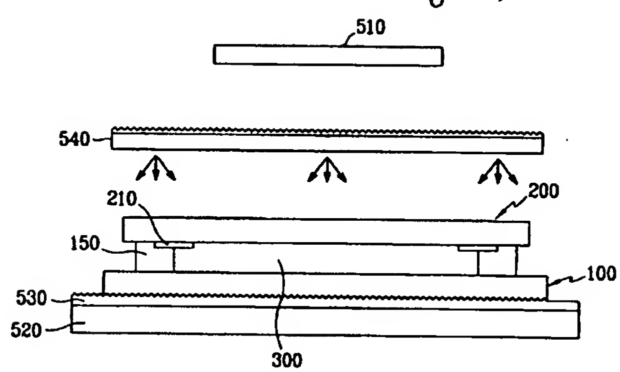
도면 3a (Fig. 3a)



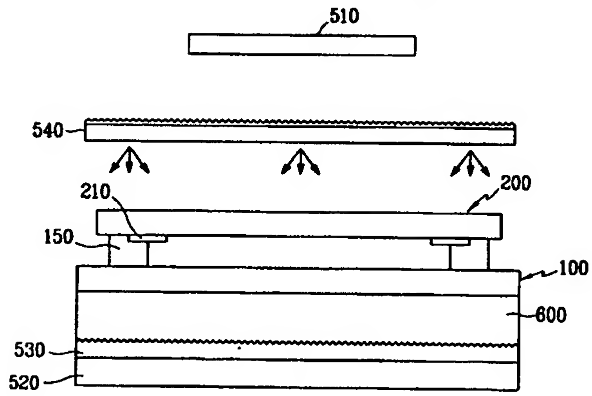
도면 3b (Fig. 3b)



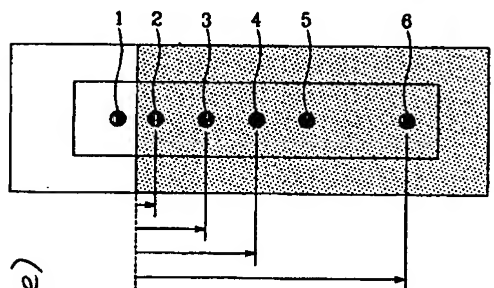
도면 4 (Fig. 4)



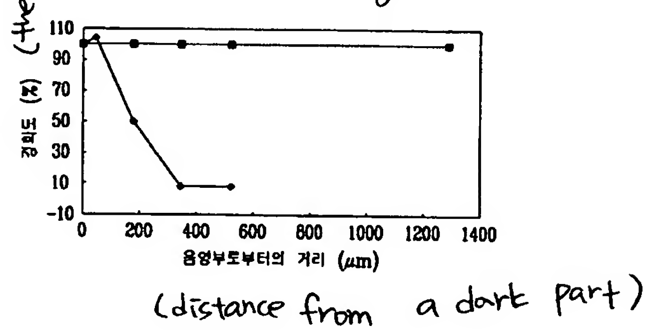
도면 5 (Fig.5)



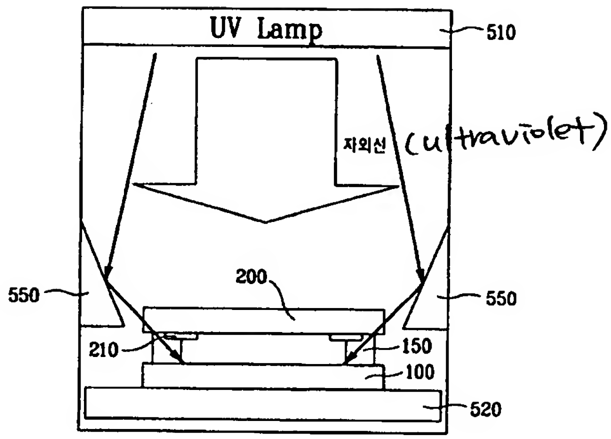
도면 6 (Fig.6)



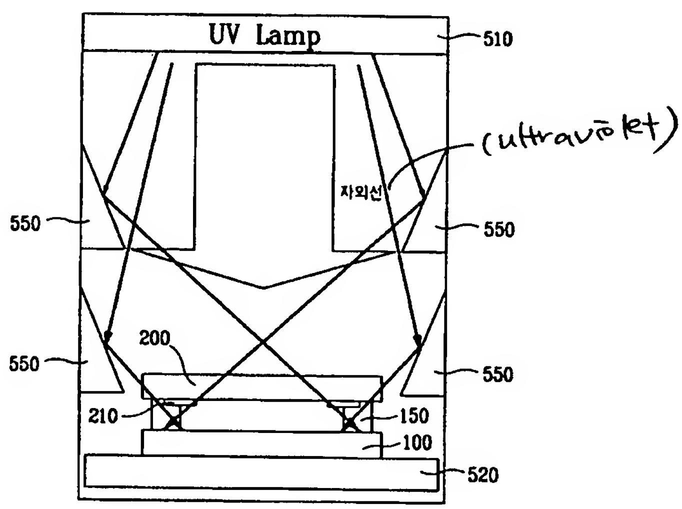
도면 7 (Fig.7)



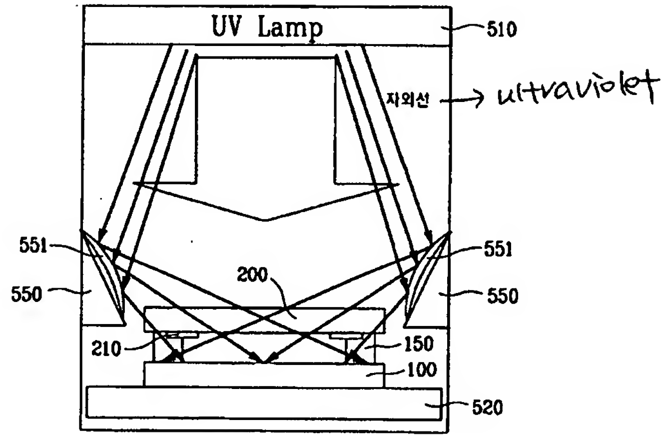
도면 8 (Fig. 8)



도면 9 (Fig. 9)



도면 10 (Fig.10)



도면 11 (Fig.11)